AD-A120 229 CORPS OF ENGINEERS ST PAUL MN ST PAUL DISTRICT F/G 13/2
MODIFICATION PROJECT, BIG STONE LAKE-WHETSTONE RIVER, MINNESOTA--ETC(U)
1980

UNCLASSIFIED NL

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE	READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER	2. GOVT ACCESSION NO. AD-A120 229 / 3. RECIPIENT'S CATALOG NUMBER
TITLE (and Subtitle) MODIFICATION PROJECT, BIG STONE LAKE-WHETSTONE RIVER, MINNESOTA AND SOUTH DAKOTA, Draft supplement to Environmental Impact Statement.	5. TYPE OF REPORT & PERIOD COVERED Draft supplement - EIS
	6. PERFORMING ORG. REPORT NUMBER
AUTHOR(s)	8. CONTRACT OR GRANT NUMBER(s)
PERFORMING ORGANIZATION NAME AND ADDRESS U.S. Army Engineer District, St. Paul 1135 U.S. Post Office and Custom House St. Paul, MN 55101	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
CONTROLLING OFFICE NAME AND ADDRESS	12. REPORT DATE 1980?
	13. NUMBER OF PAGES 26
MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)	15. SECURITY CLASS. (of this report) Unclassified
	15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

See also Final supplement, EIS

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Environmental impact statements
Environmental assessment
Big Stone Lake
Whetstone River

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This supplement has been prepared to address a significant alignment change for the proposed diversion channel into the project U.S. Highway 75 Reservoir in the Big Stone National Wildlife Refuge. Besides aesthetic impacts, construction and disposal would adversely impact about 45 acres of habitat in the Refuge and about 55 acres above the Refuge.

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

Big Stone Lake
Whetstone River

DRAFT SUPPLEMENT
ENVIRONMENTAL IMPACT STATEMENT
MODIFICATION PROJECT
BIG STONE LAKE-WHETSTONE RIVER
MINNESOTA AND SOUTH DAKOTA

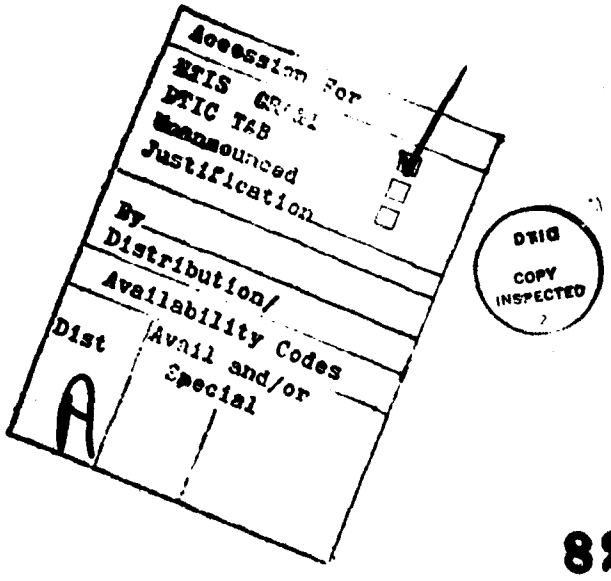
Abstract: The Big Stone Lake-Whetstone River Modification Project was authorized by the Flood Control Act approved 27 October 1965. The Final Environmental Impact Statement was filed with the President's Council on Environmental Quality on 18 December 1971. Construction has been completed for all project features except for the upstream works on the Minnesota River and the areas of rechannelization and bank stabilization on the lower 4 miles of the Whetstone River.

This supplement has been prepared to address a significant alignment change for the proposed diversion channel into the project U.S. Highway 75 Reservoir in the Big Stone National Wildlife Refuge and to fulfill requirements which were established subsequent to preparation of the final EIS: (1) the Endangered Species Act of 1973, as amended, and (2) Section 404(b) of the Clean Water Act of 1977 and applicable Corps of Engineers regulations and guidance. The supplement itself consists of three parts: (1) an evaluation of the significant environmental impacts which would be expected to result from construction of the diversion channel along the new alignment; (2) a Section 404(b)(1) evaluation of all remaining fill activities associated with work on the Whetstone and Minnesota Rivers; and (3) a biological assessment which addresses the impacts of remaining work on all currently listed threatened and endangered species.

Send your comments to the District Engineer by 27 June 1980.

If you would like further information on this statement, please contact:

Mr. Robbin Blackman
Environmental Resources Branch
St. Paul District, Corps of Engineers
1135 U.S. Post Office and Custom House
St. Paul, Minnesota 55101



DRAFT SUPPLEMENT
ENVIRONMENTAL IMPACT STATEMENT
MODIFICATION PROJECT
BIG STONE LAKE-WHETSTONE RIVER
MINNESOTA AND SOUTH DAKOTA

TABLE OF CONTENTS

LIST OF PLATES

LIST OF EXHIBITS

PART I: IMPACT ASSESSMENT OF NEW DIVERSION CHANNEL

1.00 NEED FOR AND OBJECTIVES OF ACTION

Study Authority

1.01 The Big Stone Lake-Whetstone River Modification Project was authorized by the Flood Control Act of 1965.

Public Concerns

1.02 Construction work has been completed on all project features except the diversion channel and associated works on the Minnesota River and construction of erosion control works in the downstream reach of the Whetstone River. Since the project cannot provide the authorized flood protection until the remaining works are completed, the primary public concern is that the remaining construction be completed as soon as possible.

Planning Objectives

1.03 The primary planning objective was to design the diversion channel alignment so that it would be acceptable to all concerned individuals and agencies.

2.00 ALTERNATIVES

2.01 The only alternatives being considered in this supplement are (1) a proposed design change that reduces channelization of the Minnesota River and that changes the location of the proposed diversion channel from the west to the east side of the Minnesota River and (2) the no action alternative.

East Alternative

2.02 The alternative diversion channel alignment would consist of a new channel as shown on Plate 1. At the point of diversion, a riprapped restriction would be placed in the existing river channel and a weir would be placed across the new channel. The weir would restrict normal flows to the existing channel. Steel sheetpiling, fill, and gabion protection would provide a weir height of about 2 1/2 feet. Riprap would be placed upstream and downstream of the weir and on the channel nose separating the new channel from the riprapped restriction on the existing channel. At approximately 1 mile downstream of the diversion, the new channel would cross the existing channel. Riprap would be placed at the intersection of the two channels, and a riprapped restriction would be placed on the continuation of the existing channel (which is several feet lower than the new channel would be at this point). A concrete paved crossing of the new channel would be provided downstream of the intersection. The crossing would be used for maintenance, public hunting, and operation and maintenance in the wildlife refuge.

2.03 The proposed channel would enter the Big Stone National Wildlife Refuge on the north boundary, one-eighth mile north of the intersection of the channel alignment and the Minnesota River. The channel would continue into the refuge for approximately 1 mile where it would terminate in an existing ditch. New channel width in reaches above the Minnesota River intersection would gradually increase from about 50 feet to 100 feet. Above the intersection, the total width, including the disposal mounds, averages 400 feet. Below the intersection, the channel would be about 200 feet wide (400 feet including levees) to its end at the drainage ditch. The weir downstream of the intersection would increase flows going down the Minnesota River from about 100 to 200 cubic feet per second under low pool conditions of the Highway 75 Reservoir.

No Federal Action

2.04 This alternative implies that the Federal Government, acting through the Corps of Engineers, would take no further action to complete the Big Stone Lake-Whetstone River project.

3.00 AFFECTED ENVIRONMENT

Environmental Conditions

3.01 Within the project area, the Minnesota River Valley is a broad alluvial plain averaging about 2 miles wide and broken by prominent granite knolls and elongated ridges of glacial drift that lie approximately parallel to the axis of the valley. In the Minnesota River Valley above U.S. Highway 75 is a two-pool retarding basin built for flood control and wildlife benefits as part of the Big Stone Lake-Whetstone River Modification Project. This 10,000-acre reservoir forms part of the Big Stone National Wildlife Refuge.

3.02 Land in the private sector of the valley is used for cultivation and livestock pasture. Riparian timberland is found along the Minnesota River channel and in scattered patches in the valley. Urban land uses are associated with Big Stone City, South Dakota, and Ortonville, Minnesota. Big Stone Canning Company is the major industrial land user of the area.

3.03 Prior to construction of the Highway 75 Dam and Reservoir, much of the sediment carried by the Minnesota and Yellow Bank Rivers was deposited in Marsh Lake. The existing average annual sediment load for these two rivers was computed to be 17.0 acre-feet for the Minnesota River at Ortonville and 20.4 acre-feet for the Yellow Bank River near Odessa. Land treatment measures proposed by the Soil Conservation Service for the Whetstone and Yellow Bank Watersheds would reduce these amounts. During flood events, some of this sediment load would have been deposited in overbank areas upstream of Marsh Lake and, therefore, would not have reached the lake.

3.04 Construction of the Highway 75 Dam reduced the sediment load reaching Marsh Lake. It was estimated that initially the Highway 75 Reservoir would trap 86 percent of the incoming sediment load. The project would not change

the Yellow Bank River sediment load and would have only a minor effect on the Minnesota River sediment load. Therefore, the sediment load passing through the Highway 75 Dam would initially be only about 14 percent of the preproject sediment load. The trap efficiency of the reservoir will slowly decrease; however, a long reservoir life is expected because the conservation pool storage of 11,700 acre-feet is many times larger than the total sediment load entering the reservoir. Sedimentation in the reservoir will be monitored every 5 years. Because of the nature of the terrain and shape of the pool, the sediment would not be deposited uniformly in the pool. The sediment transported by the Whetstone River to the Minnesota River would form a delta in the upper end of the reservoir while the sediment carried by the Yellow Bank River would be deposited in a delta at the mouth of the Yellow Bank River in the lower reaches of the reservoir.

Significant Resources

3.05 The resources of the National Wildlife Refuge would be affected by the Corps work on the Minnesota River. (The impacts are discussed in section 4.00 below.) The project area lies within the range of the endangered Arctic peregrine falcon. An assessment of the impacts of the project upon the peregrine falcon is given in Part III of this report.

3.06 As of 15 April 1980 no sites listed on the National Register of Historic Places or eligible for inclusion on the Register were located in or near the project area.

3.07 Resources of the project area that are of concern to local interests include the cultivated and pastureland and the recreational uses of the river corridor. Potential undesirable impacts on river valley use could occur during construction of the project.

4.00 ENVIRONMENTAL EFFECTS

General

4.01 This section will briefly discuss the significant environmental effects of the proposed alternative channel alignment plan. It is divided into two subsections: (1) the immediate effects of construction of the alternative plan, and (2) the possible long-term impacts on the project area and region.

Immediate Effects of Construction

4.02 Construction of the diversion structure and associated entrance channel to the Minnesota River and construction of the weir at the downstream confluence of the bypass channel and the river would temporarily increase turbidity and siltation. A majority of the new channel construction would be accomplished in the dry. The entrance channel works and the weir and downstream confluence works are the only segments of the project in which work may not be able to be done in the dry. These activities could temporarily increase the silt load entering the Big Stone National Wildlife Refuge via the natural river channel. Every effort will be made to accomplish these activities during low water periods to keep impacts to a minimum.

4.03 A few local residences would suffer from temporary disturbance due to increased noise levels, dust, exhaust emissions, and possible ground vibrations during construction activities. Some temporary loss of access to grazing land may be encountered until construction has been completed and livestock passways can be built for traversing the channel and levee.

4.04 The east alternative alignment would pass through an area of scattered hardrock outcroppings. If surface or underground solid rock is encountered during construction of the new channel, some blasting would be required. The blasting would adversely affect the local area by introducing additional noise vibration impacts on local residences, livestock, and wildlife. Blasting could increase the length of construction time by 3 to 6 months.

4.05 The construction phase of the project could be expected to generate an undetermined but possibly significant amount of economic activity in the lightly populated, highly agricultural and recreational based towns of Ortonville and Odessa, Minnesota, and Big Stone City, South Dakota.

Possible Long-Term Impacts

4.06 Construction of the diversion channel and disposal of excavated materials would adversely impact about 45 acres of habitat in the Big Stone National Wildlife Refuge: 30 acres of old field dominated by quackgrass, bromegrass, and exotic annual and perennial herbs; 10 acres of floodplain woodland, composed chiefly of mature cottonwood, willow, elm, ash, boxelder, and silver maple; and 5 acres of sedge and grass wetland. Loss of habitat can be mitigated somewhat by planting the levees, channel banks, and bottoms with native grasses and other prairie plants compatible with the ecological conditions and project operation. Lowland hardwood habitat loss would have a long-term adverse impact on wildlife because regeneration of woody species would not occur, thus eliminating cover in the immediate project area and causing a break in the natural corridor of the lowland woods associated with the river.

4.07 Construction above the wildlife refuge would adversely impact about 55 acres. About 25 acres is old field, which is infrequently used for pasture. Beyond these fields, the channel would pass through about 30 acres of grazed floodplain woodlands. Impacts to this agricultural area would not be significant because these lands have limited productivity due to frequency of flooding and heavy grazing.

4.08 Construction of the entrance channel works and of the downstream confluence and placement of riprap around the downstream confluence would eliminate about 1,500 feet of benthic habitat. Impacts of construction to aquatic and benthic resources would be minimal because the river almost yearly becomes dry. Adverse impacts would be limited to organisms which remain in the drying riverbed.

4.09 The proposed channel works in conjunction with overall project operation could have some adverse impacts on the Big Stone National Wildlife Refuge. Wildlife and recreation resources of the refuge are closely related to water levels on the refuge pools. Waterfowl generally construct their nests, beginning in early May, with the bottom of the nest bowl approximately 6 inches above the water surface. A possible adverse impact to waterfowl populations could be expected if sudden rises of more than 6 inches occur during May and June. High water flows which would have enough volume to raise the pool water level occur early in spring during snowmelt before nesting time. Spring and summer rainstorms also could raise pool elevation, but impact on waterfowl would be similar regardless of project alternatives and plans.

4.10 Proposed modifications of the Big Stone Lake outlet structure and silt barrier will have a minor effect on the sediment load down the Minnesota River. Although the total amount of sediment entering the Highway 75 Reservoir will be the same for the approved diversion channel alignment shown in Design Memorandum No. 3 and the presently proposed east alignment, the different diversion alignments could cause some minor change in the location of the delta formed. For both alignments, however, the amount of sediment going down the existing Minnesota River channel would be much less than that going down the diversion channel since the majority of flood flows would follow the diversion channel and since flood flows carry most of the sediment load. For the Whetstone River, the highest 5 percent of the flows transport over 90 percent of the sediment load. The U.S. Fish and Wildlife Service has expressed concern that the sediment storage in the Highway 75 Reservoir would be exhausted before the project reached its design life. Their concern was based on the earlier sediment volume estimates. As discussed above, the present study indicates that the storage capacity is more than adequate.

4.11 In general, it appears that less sediment would be transported down the natural Minnesota River bed below the downstream confluence with the proposed bypass channel during periods of high water. This would have a possible long-term impact by scouring and washing away the riverbed without an approximately equal amount of sediment that could be deposited in the riverbed. The natural cyclic process of erosion and sedimentation would be altered.

4.12 Modifying the design of the presently proposed diversion channel to allow more flow down the existing channel before the diversion is used would have only a minor impact on sedimentation in the existing channel. Preproject low flow velocities in the channel were low, less than 2 feet per second, and backwater caused by the Highway 75 pool lowers them further. The normal pool elevation in late spring through early winter is 952.3 feet m.s.l., and the channel bottom elevation where the proposed diversion channel would cross the existing channel is about 949. Thus, for no flow, the pool would extend past or upstream of this point in the channel. For discharges of 100 and 200 cfs, the normal pool effect would extend to about the middle of Section 25 (3.5 miles downstream of the crossing of the proposed diversion channel and the existing channel). Downstream of this point, varying the amount of low flow down the channel would have almost no effect on sedimentation because the velocities are very low, less than 0.5 foot per second with the normal pool. Between this point and the point where the proposed diversion would cross the existing channel, varying the amount of low flow would have only minor effects on sedimentation because the velocities for low flow are generally less than 1.0 foot per second. Velocities this low would probably not be able to move sediment accumulated during flood flows.

4.13 Reconnaissance level cultural resources surveys were undertaken in the Big Stone-Whetstone Flood Control Project area in 1974 and 1975 by archeologists from the University of Minnesota. One site was located during the 1974 survey but was deemed too disturbed to warrant further attention. No sites or structures of historic or prehistoric significance were located during the 1975 survey.

4.14 Another reconnaissance survey will be undertaken in May 1980 in the area of the proposed channel realignment to the east of the Minnesota River. Information elicited during this survey will be included in the Final Supplement to the EIS.

4.15 The National Register of Historic Places has been consulted and, as of 15 April 1980, no sites listed on or determined eligible for the Register were in the project area. Coordination of the draft report with the State Archeologist the State Historic Preservation Officer, and the Heritage Conservation and Recreation Service will be initiated upon completion of the surveys.

PART II:
SECTION 404 (b) EVALUATION OF UPSTREAM WORKS ON THE BIG STONE LAKE - WHETSTONE RIVER PROJECT

The following is an evaluation of the proposed construction and fill activity in accordance with the requirements of Section 404 of the Clean Water Act of 1977 (33 U.S.C. 1344).

1. PROJECT DESCRIPTION

a. Fill Activities Associated with Project Work

(1) Modification of a silt barrier on the Minnesota River, including placement of Cofferdams (A) during construction (see Plate 6 for the location of Cofferdams (A).

(2) Modification of 1 mile of the Minnesota River (see Plate 1 and Plate 2 for typical sections).

(3) Realignment of 1 mile of the Minnesota River, including placement of a channel plug in the old channel, a weir in the new channel (see Plate 1 and Plate 2 for typical sections).

(4) Modification of a control structure on the Minnesota River, including placement of upstream and downstream Cofferdams (B) during construction (see Plate 6).

(5) Excavation work of the Whetstone River (see Plates 3, 4, 5, 6).

(6) Bank stabilization in an upstream reach of the Whetstone River (see Plate 7).

b. Description of the Proposed Discharge of Dredged or Fill Materials

(1) General Characteristics of Material - Fill material would consist of rock for riprap, derrick stone, bedding material, and sand fill selected from channel excavation.

(2) Quantity of Material Proposed for Discharge - Modification of the silt barrier would require placement of 830 cubic yards (cy) of bedding, 1655 cy of derrick stone, and 545 cy of riprap into the Minnesota River. An unknown quantity of random fill would be used for two cofferdams needed during silt barrier construction; the quantity would depend on the amount of flow in the Minnesota River. Fill for control structure modification would require 510 cy of bedding, 135 cy of derrick stone, and 910 cy of riprap, as well as 3,000 cy of silty sand fill for two cofferdams needed during construction. Access roads and a culvert for a parking area near the control structure would call for placement of 40 cy of riprap and 20 cy of bedding into the Minnesota River, after the control structure modification is complete. Enlargement of the Minnesota River would require placement of 420 cy of riprap, 200 cy of bedding, and 350 cy of silty sand fill. Realignment of the Minnesota River would require 11,600 cy of silty sand fill, 2,870 cy of riprap, and 1,435 cy of bedding for channel restrictions and channel intersection construction. Work on the Whetstone River would also require fill placement. Bank stabilization would include placement of 1,460 cy of riprap, 690 cy of bedding, and 2,730 cy of sand fill in the river. Work on the Whetstone River diversion channel would require placement of 1,200 cy of riprap, 560 cy of bedding over slope areas prepared with at least 2,000 cy of silty sand fill, and placement of at least 14,000 cy of silty sand fill to shape the channel slopes.

(3) Source Of Material - Rock for riprap, derrick stone, and suitable bedding material is available from areas located between 5.0 and 7.0 miles from the Whetstone River project area. Quarried granite for riprap and bedding and concrete aggregate for work on the Minnesota River are available from a commercial source, located 3½ miles west of Odessa, Minnesota. Natural sand and gravel is available from a commercial gravel pit in South Dakota, located 20 miles west of Odessa, Minnesota, as well as from others near Ortonville, Minnesota, and Big Stone City, South Dakota. Random and channel fill materials would be obtained from channel excavation. Material placed in water would be composed of clean gravel, sand, and silty sands and would be suitable for construction purposes.

c. Description of the Proposed Disposal Sites for Dredged or Fill Material

(1) Location - The upstream works on the Whetstone River are located on the eastern boundary of South Dakota near Big Stone City and on the western boundary of Minnesota near the City of Ortonville. The upstream works on the Minnesota River are located in a reach of the river extending about 3½ miles downstream from Big Stone Lake (Plate 1).

(2) Type of Disposal Sites - Most fill activities, other than cofferdam construction, would be done in a dry form after the water has been redirected to the opposite side of the channel. Water would not cover the material until after construction and riprapping. In most cases, fill would be placed on the sides of existing banks. Temporary cofferdams would be constructed by placing fill material directly into the river channels at various points. Modification of the silt barrier and control structure would require placement of fill at existing structures, in a dry state.

(3) Method of Discharge - Fill placed in water would be placed by dump-trucks, dozers, and cranes equipped with clamshell buckets and draglines.

(4) When Will Disposal Occur? - Disposal would occur during calendar years 1981 and 1982.

(5) Projected Life of Disposal Sites - The life of the project is 100 years.

(6) Bathymetry - The rivers are generally shallow with uneven sandy bottoms. Silt deposits occur in areas of little current. High silt loads are characteristic of the rivers, and sedimentation in both the rivers and Big Stone Lake is a problem to local landowners.

2. PHYSICAL EFFECTS

a. Potential Destruction of Wetlands - Effects on (40 CFR 230.4-1(a) (1) (i-vi))

(1) Foodchain Production - Invertebrate habitat would be destroyed when fill and riprap are placed in the rivers. Recolonization by new species adapted to living on gravel and rock substrates probably would occur after construction is completed. Terrestrial animals in riparian habitat destroyed by channelization would be displaced. Revegetation after construction is completed would reduce the long-term effects.

(2) General Habitat - General habitat in channelized areas and those areas covered with fill and riprap would be altered. Temporary increases in turbidity during cofferdam construction would adversely affect aquatic biota, especially algae and invertebrates which form the base of the foodchain. Rock and gravel placed during project construction would provide habitat for some aquatic species after construction is completed, thus reducing long-term adverse impacts. Revegetation of upland areas altered by construction would reduce the long-term impacts on terrestrial species.

(3) Nesting, Spawning, Rearing and Resting Sites for Aquatic or Land Species - Yellow perch spawning sites in rooted vegetation could be covered with fill. Disposal banks in channelized areas would be unstable for burrowing activities of muskrat and other mammals. Removal of streamside vegetation on one side could eliminate some shading over the river which might be required by some invertebrates.

(4) Areas Set Aside for Aquatic Environmental Study or Sanctuaries or Refuges - Suspended material entering Big Stone National Wildlife Refuge could reduce the utility of this refuge as an area for waterfowl.

(5) Natural Drainage Characteristics - Drainage would be accelerated in the channelized portion of the Whetstone and Minnesota Rivers. Realignment of the lower Minnesota River provides for drainage of low flows along the existing Minnesota River channel, and drainage of high flood flows along the new channel to the existing drainage ditch system leading to the project reservoir. High flows (above 10-year flood level) would enter the reservoir via the new channel work and the existing ditch system at the upper end of the reservoir. Normal flows would enter the reservoir via the existing Minnesota River channel at about the midpoint of the reservoir.

(6) Sedimentation Patterns - The change in operating plan and modifications to the silt barrier would reduce sedimentation downstream. The amount of silt deposited into Big Stone Lake from the Whetstone River is very small and no significant change will occur. Sediment load to the Highway 75 Reservoir would be slightly reduced by the proposed project.

(7) Salinity Distribution - Not applicable.

(8) Flushing Characteristics - Base flow characteristics of the river systems would not be changed. Water, however, would flow faster in channelized areas, and 90 percent of the mixing and settling in Big Stone Lake would be eliminated.

(9) Current Patterns - Current would be accelerated in channelized areas, but base flow characteristics in the river channels would not be changed significantly by the project due to modifications of the outlet control structure.

(10) Wave Action, Erosion, or Storm Damage Protection - The channel slopes, 20-foot berm, disposal banks, sand fill areas, channel plugs, and the channel bottom of the new diversion channel would be seeded with native prairie grasses. Riprap would be placed on the top and slopes of the channel plug used to divert floodwaters down the new channel instead of the Minnesota River.

(11) Storage Areas for Storm Waters and Floodwaters - Fill activities themselves would not have an effect on storage areas for storm waters and floodwaters.

(12) Prime Natural Recharge Areas - Groundwater and prime natural recharge areas are not expected to be affected significantly by the proposed project. The source of the municipal water supply at Ortonville is groundwater pumped from a near-surface sand and gravel aquifer. The groundwater is a more than adequate supply for the city's needs as the aquifer is recharged from Big Stone Lake.

b. Impact on Water Column (40 CFR 230.4-1(a)(2))

(1) Reduction in Light Transmission - Increased turbidity during and shortly after construction in channelized areas would have minor effects on light transmission. Riprap would stabilize banks and reduce erosion of silt and other bank materials into the water.

(2) Aesthetic Values - Placement of fill materials would cause an increase in turbidity during construction and would temporarily make the rivers aesthetically displeasing to recreational users.

(3) Direct Destructive Effects on Nektonic and Planktonic Populations - Minor adverse impacts would occur as a result of increased turbidity during construction. Those organisms dependent on large amounts of light would be adversely affected by turbid conditions. Planktonic populations would decline or be eliminated in the affected area as a result of reduced light penetration.

c. Covering of Benthic Communities (40 CFR 230.4-1(a)(3))

(1) Actual Covering of Benthic Communities - Little is known of benthic communities in the construction area, but they probably would be destroyed when covered with fill. Those organisms dependent on vegetation and other substrate that would be covered with riprap and fill would be destroyed. Recolonization by the same species may not be possible on the new rock and gravel substrate.

(2) Changes in Community Structure or Function - Fill and riprap activities would cover and eliminate some benthic communities. Recolonization from adjacent communities would occur after construction if the new substrate is suitable habitat. It is likely that new species would be attracted to the riprap material.

d. Other Effects (40 CFR 230.4-1(a))

(1) Changes in Bottom Geometry and Substrate Composition - Riprap would cover the existing uneven sandy and silty surface of the riverbanks with a flat surface of rocks with slopes of 1 vertical on 3 horizontal. The bank stabilization projects would help decrease the amount of silt settling to the bottom of the rivers in areas of little current.

(2) Water Circulation - Modification of the outlet control structure on Big Stone Lake would permit 90 percent of the water from the Whetstone River to pass directly into the Minnesota River without first circulating in Big Stone Lake, if storage is available in the Highway 75 Reservoir.

(3) Salinity Gradients - Not applicable.

(4) Exchange of Constituents Between Sediments and Overlying Water with Alterations of Biological Communities - Fill activities would cover the existing sandy bottom sediments. The new condition with the fill would not provide habitat for organisms which have the ability for chemical exchange between constituents in the sediments and overlying water.

3. CHEMICAL-BIOLOGICAL INTERACTIVE EFFECTS (40 CFR 230.4-1(b))

a. Does the Material Meet the Exclusion Criteria?

Most fill material would meet the exclusion criteria. The exclusion criteria state that dredged or fill material may be excluded from this evaluation if it is composed predominantly of sand, gravel, or any other naturally occurring sedimentary material with particle sizes larger than silt, characteristic of and generally found in areas of high current or wave energy such as streams with large bed loads. Riprap, derrick stone, bedding materials, and concrete meet the exclusion criteria because of their non-liquid and clean nature. The exclusion criteria also state that fill material may be excluded if it is substantially the same as the substrate at the proposed disposal site, is sufficiently removed from sources of pollution to provide reasonable assurance that the material has not been contaminated by pollution, and is discharged so that material will not be moved by currents in a manner damaging to the environment outside the disposal site. Sand fill selected from dredged material and used for bank stabilization and enlargement activities meets these criteria.

4. DESCRIPTION OF SITE COMPARISON (40 CFR 230.4-1(c))

a. Total Sediment Analysis (40 CFR 230.4-1(c)(1))

Sediment samples from the proposed construction sites were collected in January 1979 (see Exhibit 1). These samples were analyzed by the United States Geological Survey in February 1979 for heavy metals, organics, and nutrients. Analysis down to 1 part per million shows no detectable levels of 16 different organics in five of the samples. Sample number 4 shows 0.7 part per million of both DDT and Dieldrin. Sample number 7 shows 1.7 parts per million of DDE and 2.8 parts per million of DDT. (Results of sediment analyses are shown in Exhibit 1.) The use of tested river bottom fill material and clean rock, gravel, and sand presents no major environmental impact in regard to concentration differences of critical constituents between the fill site and the fill material.

b. Biological Community Structure Analysis (40 CFR 230.4-1(c)(2))

Fill material would either be non-aquatic or would be selected from the stream channel adjacent to the fill site and probably would not contribute any species to the biological community structure at the fill sites.

5. APPLICABLE WATER QUALITY STANDARDS

a. Compare Constituent Concentrations

The constituent concentrations of the fill material are related to the source of the fill material. The riprap and bedding and some fill will be clean sand, gravel, and rock, minimizing the potential for constituent exchange. Some

small amounts of exchange could occur with the introduction of such fill items as gabions and concrete. The dredged fill material will be silty sand similar to that of the fill site. Fill will come from tested, clean deposits only. Constituent exchange in the fill material would be similar to the exchanges that currently occur on naturally eroding and depositing material in the area.

b. Mixing Zone

Not applicable. No liquid would be discharged into the river.

c. Based on a. and b. Above, Will Fill Operations Be in Conformance with Applicable Standards?

The project would not affect the river's ambient quality and is in conformance with applicable standards.

6. SELECTION OF DISPOSAL SITES (40 CFR 230.5) FOR DREDGED OR FILL MATERIAL

a. Need for the Proposed Activity

Modification of the existing silt barrier would help prevent sediment from entering Big Stone Lake, would improve recreation, and would be the only item of construction not required for flood control. Lakeshore interests at the lower end of Big Stone Lake claim that serious property devaluations would result if the siltation were to continue unchecked. Conservation interests report that damage to fish life results from the present siltation problem, and recreation interests note that the lake is becoming less desirable for boating and swimming. Social gains as a result of this project would be a reduction in flood damages and the maintenance of an optimum elevation in Big Stone Lake.

b. Alternatives Considered

Alternative projects for flood control and elimination of sedimentation in Big Stone Lake could not be justified on the basis of economic effectiveness. Benefit-cost analyses were computed for various combinations of the following alternatives: treatment of municipal effluents for phosphorus, feedlot run-off control, land treatment, rough fish removal, chemical algae control, dredging of bottom sediments, fencing animals out of watercourses, control of industrial wastes, and use of upstream reservoirs.

c. Objectives to be Considered in Discharge Determination (40 CFR 230.5(a))

(1) Impact on Chemical, Physical, and Biological Integrity of Aquatic Ecosystem (40 CFR 230.5(a)(1) - Fill activity would not have a significant effect on the integrity of the aquatic ecosystem. Clean rock, sand, and gravel would cause little change in water chemistry. Flow rates in channelized areas would be accelerated slightly. Fill material would cover some invertebrates, but habitat for new species may be provided at the same time.

(2) Impact on Foodchain - Invertebrate life destroyed by fill deposition might have been a food source for fish and other life forms. Silt deposits in other areas presently inhibit aquatic invertebrate production. Organisms dependent upon aquatic vegetation would be lost as the vegetation and algae are decreased due to channelization activities.

(3) Impact on Diversity of Plant and Animal Species - Aquatic vegetation would be lost, and associated animal life would probably leave the area. The impact on diversity is not expected to be significant.

(4) Impact on Movement Into and Out of Feeding, Spawning, Breeding, and Nursery Areas - Channelization and riprap placement may cover vegetation and prevent yellow perch from using traditional spawning sites.

(5) Impact on Wetland Areas Having Significant Functions of Water Quality Maintenance - No wetland areas with this function are found near the proposed fill areas.

(6) Impact on Areas that Serve to Retain Natural High Waters or Floodwaters - Provisions would be made for reducing floodwaters retained in Big Stone Lake by providing for storage in the Highway 75 Reservoir. Fill activities would have no impact on floodwater retention.

(7) Methods to Minimize Turbidity - Construction would be accomplished during low-flow periods. Water would be temporarily diverted by cofferdams so that fill placement could be done in a dry state.

(8) Methods to Minimize Degradation of Aesthetic, Recreational, and Economic Values - Channelization would affect the aesthetics of the project area by altering natural forested areas during realignment of the Minnesota River and by removing streambank vegetation during bank stabilization construction and riprap placement. Riverbanks would be replanted with trees and native grasses. The project should aid fishing in Big Stone Lake which is the most important use of the lake in terms of recreation and economic values. Fill activities would be conducted in a manner which would prevent unsightly erosion of riverbanks. (See Plate 8.)

(9) Threatened and Endangered Species - In a letter dated 30 April 1979, the U.S. Fish and Wildlife Service identified one endangered species that may be found in the area: the Arctic peregrine falcon. The project, however, would have no effect on the continued existence of this falcon.

(10) Investigate Measures that Avoid Degradation of Aesthetic, Recreational, and Economic Values of Navigable Waters - Filled portions of the project would not significantly impact aesthetic, recreational, or economic values of the navigable waters. Vegetation destroyed on streambanks during channelization would be replaced to minimize aesthetic degradations.

d. Impacts on Water Used at Proposed Fill Sites (40 CFR 230.5(b)(1-10))

(1) Municipal Water Supply Intakes - Construction of the proposed project would have no significant temporary or long-range effects on the groundwater of the area. The source of the municipal water supply at Ortonville, Minnesota (groundwater pumped from a near-surface sand and gravel aquifer) is more than adequate for the city's needs.

(2) Shellfish - Little is known of shellfish populations in the project area, but it is not expected that fill activities would have a significant impact on shellfish numbers.

(3) Fisheries - No significant fish habitat, other than the vegetative cover buried by fill material, would be affected by construction activities.

(4) Wildlife - Construction equipment would temporarily disturb some wildlife species, and removal of streambank vegetation would adversely affect some species. Revegetation after construction is completed would reduce long-term adverse effects.

(5) Recreational Activities - No significant water-related recreation activities are available in the fill areas. The upper Minnesota River provides some fishing, canoeing, and hunting recreation, but only a few localized areas along the river are considered to be of significant value.

(6) Threatened and Endangered Species - No known threatened or endangered species would be adversely affected by the proposed action.

(7) Benthic Life - Excessive silt inhibits benthic life in the project area. This silt destroys the utility of the substrate as benthic habitat. Recolonization may occur for species disturbed by channelization, and new species may be attracted to the new substrate.

(8) Wetlands - Wetlands would not be signficantly affected by fill activities.

(9) Submersed Vegetation - Submersed vegetation is not present in dense concentrations in fill areas but probably would not become established on the new substrate.

(10) Size of Disposal Site - The sites for fill and riprap activity are the smallest possible that still meet the desired project objectives.

(11) Coastal Zone Management Programs (40 CFR 230.3(e)) - Not applicable. Fill sites do not conflict with any coastal zone management programs.

e. Considerations to Minimize Harmful Effects (40 CFR 230.5(c)(1-7))

(1) Water Quality Criteria - Fill activities would not affect the ambient qualities of the rivers, as outlined in each State's regulations, if turbidity during construction is kept to a minimum.

(2) Investigate Alternatives to Open Water Disposal - Open water disposal is necessary to construct the channel plugs and cofferdams.

(3) Investigate Physical Characteristics of Alternative Disposal Sites - There are no feasible alternative sites. Channel location dictates where the fill would be placed.

(4) Ocean Dumping - Not applicable.

(5) Where Possible, Investigate Covering Contaminated Dredged Material with Cleaner Material - Dredged material to be used as a channel restriction to divert water into the new channel would be covered with clean riprap to prevent downstream movement of contaminated material possibly released during dredging.

(6) Investigate Methods to Minimize Effects of Runoff from Confined Areas on the Aquatic Environment - No confined disposal areas would be used.

(7) Coordinate Potential Monitoring Activities at Disposal Site with EPA - No monitoring activities are planned for the disposal areas.

7. STATEMENT AS TO CONTAMINATION OF FILL MATERIAL IF FROM A LAND SOURCE (40 CFR 230.5(d))

Land source fill material would be commercially purchased clean rock, gravel, sand, and concrete.

8. DETERMINE MIXING ZONE

Not applicable. No liquids would be discharged into the rivers.

PART III:
BIOLOGICAL ASSESSMENT
UPSTREAM WORKS ON THE BIG STONE LAKE-WHETSTONE RIVER PROJECT

1.00 PROJECT DESCRIPTION

Location

1.01 The upstream works project on the Whetstone and Minnesota Rivers is located on the eastern boundary of South Dakota near Big Stone City and on the western boundary of Minnesota near the city of Ortonville.

Description of Proposed Project and Purpose

1.02 The project will include alteration of the existing control structure and a silt barrier at the outlet of Big Stone Lake, channel enlargement of the Minnesota River channel for a distance of about 1 mile below the Big Stone Lake outlet control dam, construction of about 2 miles of new channel from the lower limit of the improved channel downstream into the upper reaches of the Big Stone National Wildlife Refuge, all in Minnesota; and construction of erosion control works in the downstream reach of the Whetstone River in South Dakota. The project will meet area needs for flood control, recreation, and wildlife management purposes.

Alternatives

1.03 Alternatives to the proposed action include (1) no action; (2) providing for flood storage in Big Stone Lake; and (3) transfer of floodwater downstream into existing impoundments at Marsh Lake and Lac qui Parle.

2.00 ENVIRONMENTAL SETTING

2.01 Within the project area, the Minnesota River Valley is a broad alluvial plain averaging about 2 miles wide and broken by prominent granite knolls and elongated ridges of glacial drift that lie approximately parallel to the axis of the valley. In the Minnesota River Valley above U.S. Highway 75 is a two-pool retarding basin built for flood control and wildlife benefits as part of the Big Stone Lake-Whetstone River Modification Project. This 10,000-acre reservoir forms part of the Big Stone National Wildlife Refuge.

2.02 Land in the private sector of the valley is used for cultivation and livestock pasture. Riparian timberland is found along the Minnesota River channel and in scattered patches in the valley. Urban land uses are associated with Big Stone City, South Dakota, and Ortonville, Minnesota. Big Stone Canning Company is the major industrial land user of the area.

3.00 IMPACTS OF THE PROJECT ON THREATENED OR ENDANGERED SPECIES

3.01 The U.S. Fish and Wildlife Service, in a letter dated 30 April 1979 (AFA-SE), identified one endangered species that may be found in the area: the Arctic peregrine falcon (*Falco peregrinus tundrius*).

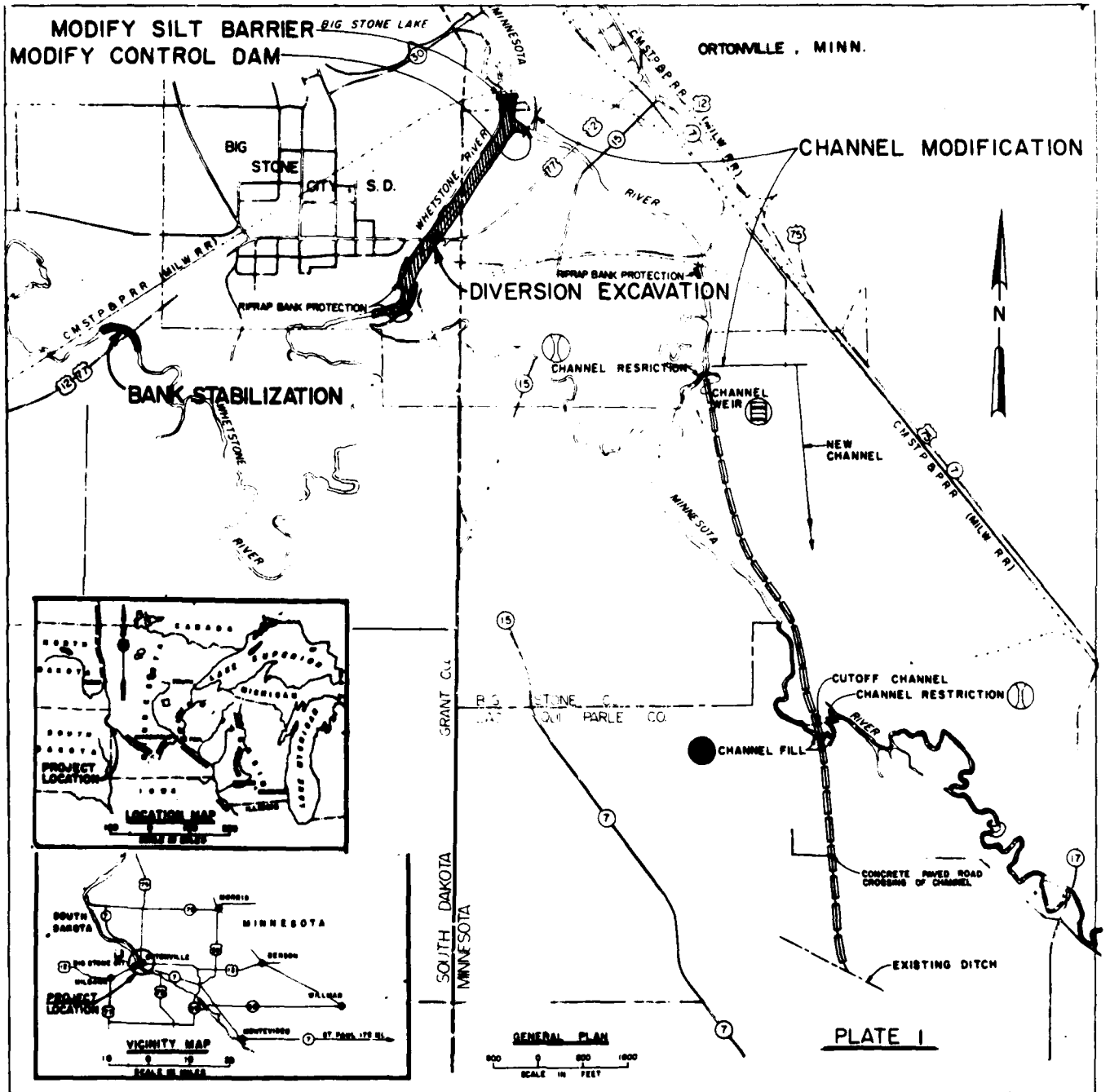
3.02 The peregrine falcon, with a historic breeding distribution throughout the United States, has apparently been extirpated from Minnesota and South Dakota (Whitney et al., 1978). The highly migratory Arctic peregrine falcon breeds in the tundra areas of North America (White, 1968). Occasional sightings of the Arctic peregrine falcon may occur in northeastern South Dakota and western Minnesota during its migration (Whitney et al., 1978; Midwest Research Institute, 1974). The upstream works on the Big Stone Lake-Whetstone River Project would have no effect on the continued existence of the peregrine falcon.

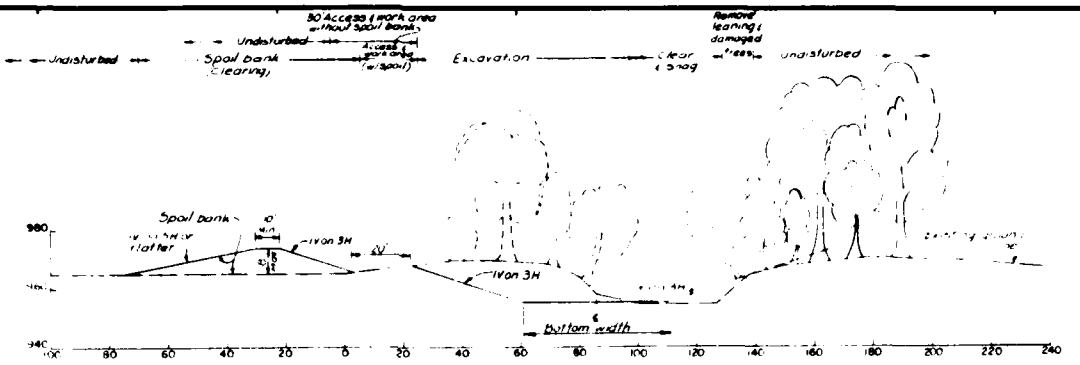
REFERENCES CITED

1. Midwest Research Institute, 1974. Natural Resources Study to Determine Causes and Alternative Solutions to the Siltation and Pollution Problems of Big Stone Lake. Contract No. DACW37-74-C-0107. Kansas City, Missouri.

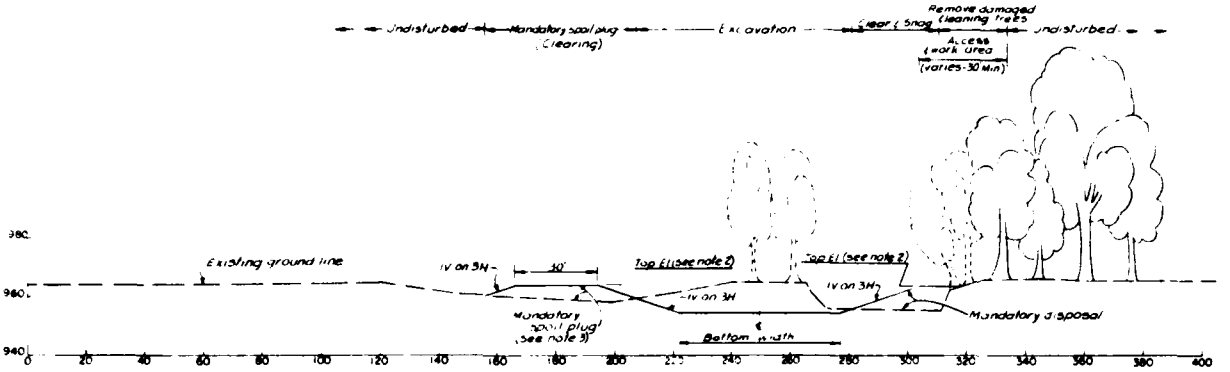
2. White, C.M., 1968. Diagnosis and Relationships of the North American Tundra-Inhabiting Peregrine Falcon. The Auk. 85(2): 179-191.

3. Whitney, N.R., et. al., 1978. The Birds of South Dakota. South Dakota Ornithologists Union with the Cooperation of the W.H. Over Museum, Vermillion, S.D.

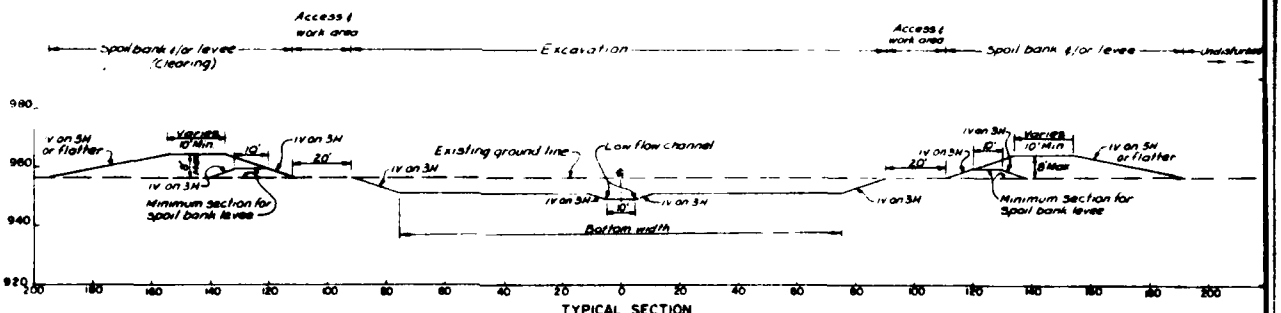

MODIFY SILT BARRIER
MODIFY CONTROL DAM
BIG STONE LAKE
MINNESOTA
ORTONVILLE , MINN.
CHANNEL MODIFICATION
BIG STONE CITY
S.D.
WHETSTONE RIVER
CM ST P & P RR (MILW RR)
RIPRAP BANK PROTECTION
DIVERSION EXCAVATION
BANK STABILIZATION
CHANNEL RESRICTION
CHANNEL WEIR
NEW CHANNEL
MINNESUTA RIVER
GRANT CO.
BIG STONE CO.
SOUTH PARLE CO.
CHANNEL FILL
CUTOFF CHANNEL
CHANNEL RESTRICTION
CONCRETE PAVED ROAD CROSSING OF CHANNEL
EXISTING DITCH
PROJECT LOCATION
LOCATION MAP
SOUTH DAKOTA
MINNESOTA
VICINITY MAP
GENERAL PLAN
SCALE IN FEET
N
PLATE 1



TYPICAL SECTION
ONE SIDE EXCAVATION
SHOWING BOTH OFF- AND ON-SITE DISPOSAL



TYPICAL SECTION
ONE SIDE EXCAVATION
SHOWING MANDATORY DISPOSAL & MANDATORY SPOIL PLUG



TYPICAL SECTION
NEW CHANNEL EXCAVATION
SHOWING SPOIL BANK LEVEE AND ON-SITE DISPOSAL

NOTES

CLEARING IN ACCESS AND WORK AREAS WILL BE RESTRICTED TO REMOVAL OF ONLY THOSE TREES REQUIRED TO PROVIDE ACCESS AND REASONABLE MANEUVERING AREA FOR WORK EQUIPMENT. EVERY EFFORT WILL BE TAKEN TO SAVE AND PROTECT ALL MATURE AND UNDAMAGED TREES WITH TRUNK DIAMETER OF 12 INCHES OR LARGER. ALL DEBRIS, DAMAGED, DEAD OR DOOMED TREES WILL BE REMOVED WITHIN THE LIMITS OF ACCESS AND WORK AREAS. DEED SPOIL BANKS AND ALL DISTURBED AREAS TO BASELINE (U.S.).

TREES AND DEBRIS SHOWN WITH DASHED LINES ARE TO BE REMOVED.

6" STRIPPED AND 6" TOPSOIL AND SEED ON SPOIL BANK LEVEE IN NEW CHANNEL EXCAVATION AREA.

SPOIL BANKS SHALL BE DISCONTINUOUS TO PROVIDE FOR DRAINAGE OF LANDWARD AREAS.

BORROW ON BASE SIDE (LANDWARD) OF MANDATORY SPOIL PLUGS SHALL BE FREE DRAINING AND SHALL NOT POND OR POCKET ANY WATER.

TOP ELEVATION OF MANDATORY SPOIL AND MANDATORY SPOIL PLUGS IS TO BE 1.0' FOOT ABOVE DESIGN WATER SURFACE.

SAFETY PAYS

SYMBOL	DESCRIPTION	DATE	APPROVAL

DEPARTMENT OF THE ARMY
ST PAUL DISTRICT, CORPS OF ENGINEERS
ST PAUL, MINNESOTA

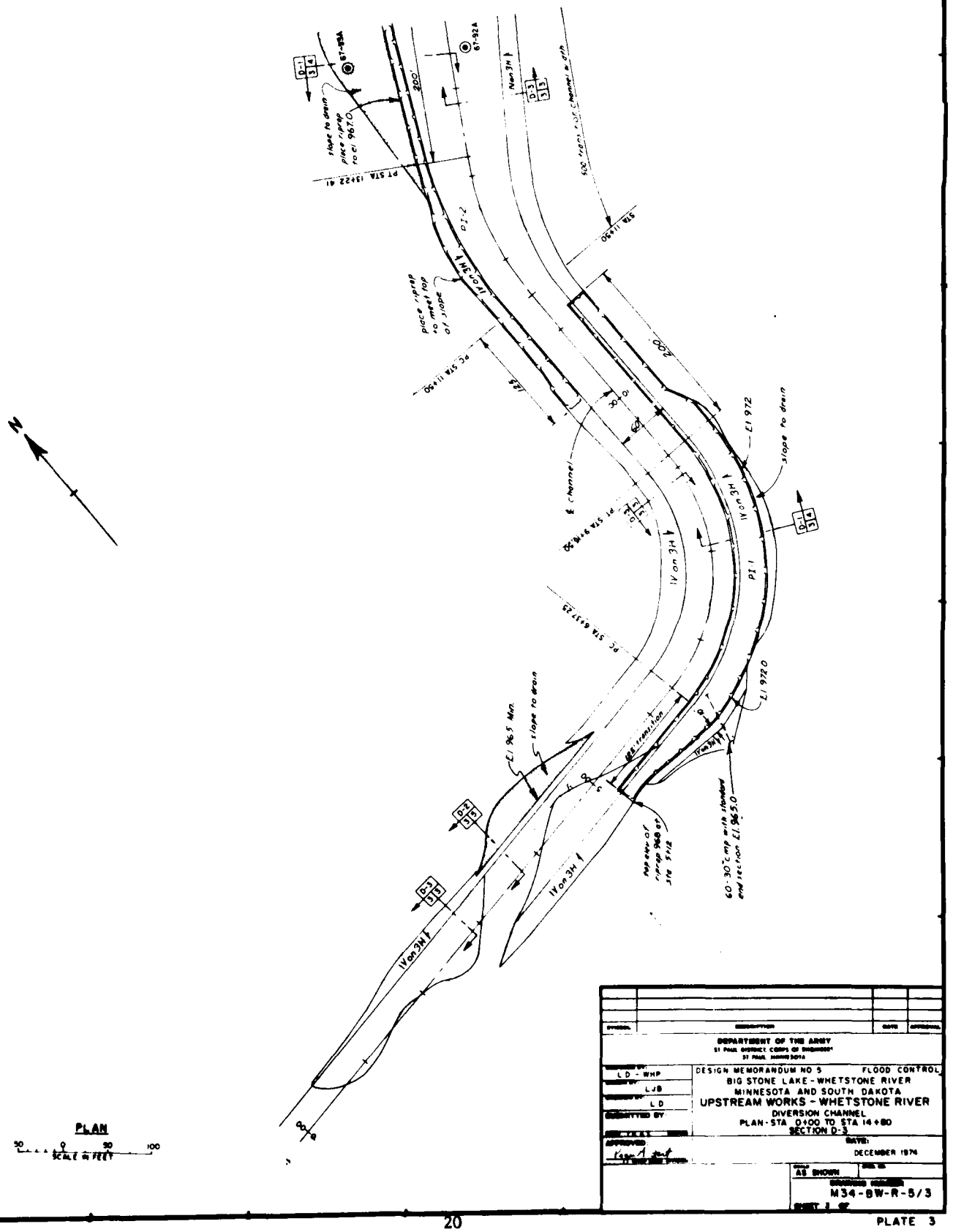
DESIGNED BY: RAJ
DRAWN BY: B S
TRACED BY:
CHECKED BY: L.D.
SUBMITTED BY:
APPROVED BY:

DESIGN MEMORANDUM NO. 5 UPPER RED RIVER
FLOOD CONTROL
BIG STONE LAKE - WHETSTONE RIVER
MINNESOTA AND SOUTH DAKOTA
TYPICAL CHANNEL SECTIONS

DATE: JUNE 1973

SCALE: NONE
DRAWING NUMBER: M54-R-5/236
SHEET 9?

PLATE 2



PLAN

50 0 50 100
SCALE IN FEET

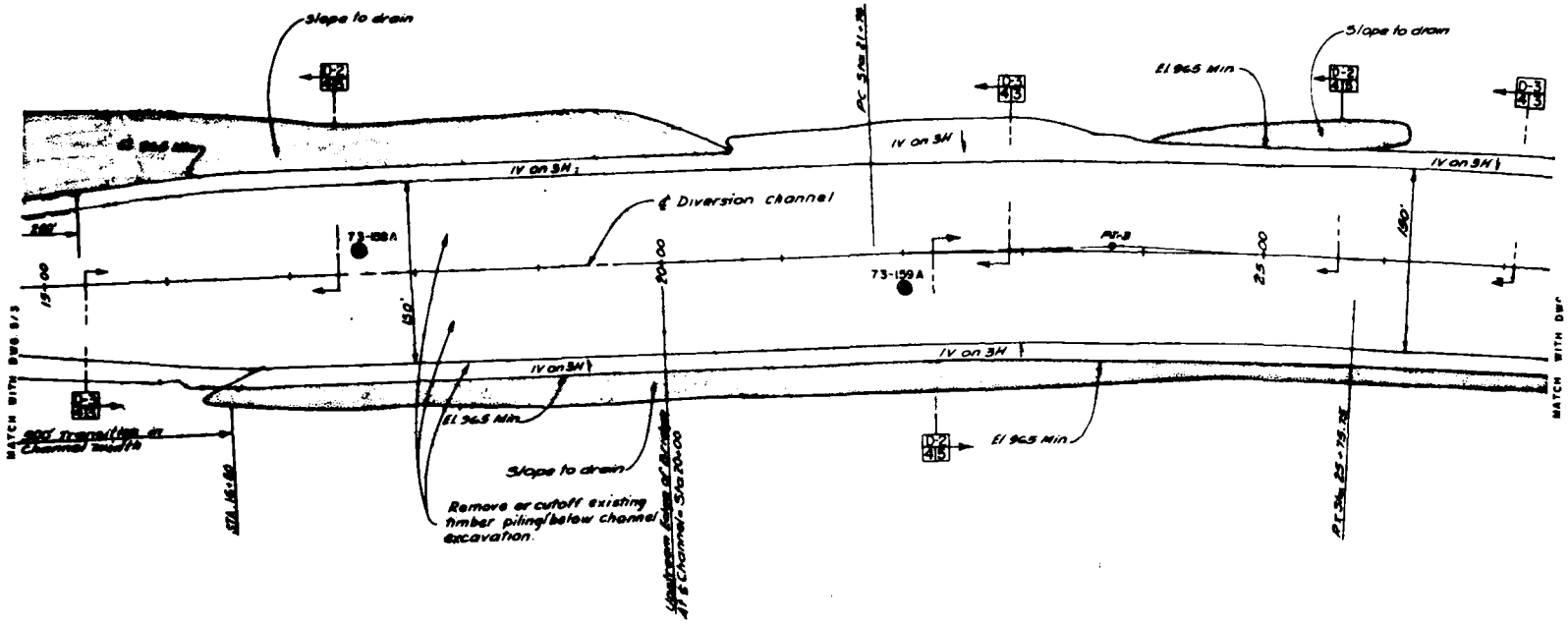
DEPARTMENT OF THE ARMY
ST PAUL DISTRICT, CORPS OF ENGINEERS
ST PAUL, MINNESOTA

DESIGNED BY	LD - WHP
DRAWN BY	LJB
TRACED BY	LD
SUBMITTED BY	
APPROVED	

DESIGN MEMORANDUM NO 5 FLOOD CONTROL
BIG STONE LAKE - WHETSTONE RIVER
MINNESOTA AND SOUTH DAKOTA
UPSTREAM WORKS - WHETSTONE RIVER
DIVERSION CHANNEL
PLAN - STA 0+00 TO STA 14+80
SECTION D-3

DATE: DECEMBER 1974
SCALE: AS SHOWN
DRAWING NUMBER: M34-BW-R-5/3
SHEET 3 OF

PLATE 3



PLAN

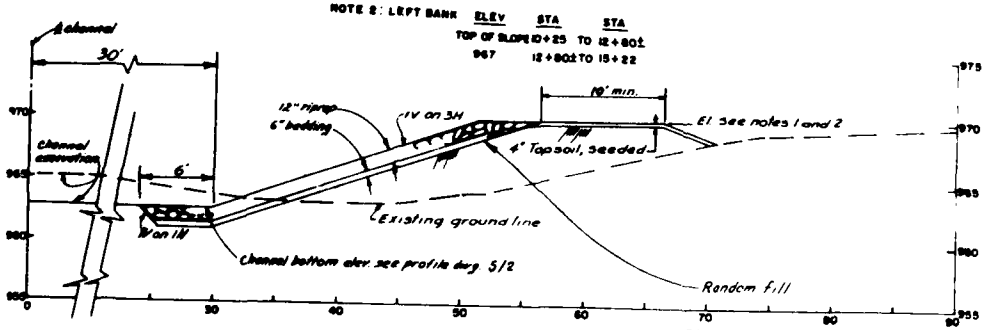
50 0 50 100
SCALE IN FEET

NOTE 1 : RIGHT BANK

ELEV	STA	STA
VARIES 966 TO 972	5+12	TO 6+37
972	6+37	TO 9+45
VARIES 972 TO 967	9+45	TO 9+75
967	9+75	TO 11+16.5

NOTE 2 : LEFT BANK

ELEV	STA	STA
TOP OF SLOPE	10+25	TO 12+80±
967	12+80±	TO 15+22



TYPICAL SECTION D-1 3/4

U. S. ARMY ENGINEER DISTRICT, ST. PAUL
CORPS OF ENGINEERS
ST. PAUL, MINNESOTA

LD - WHP
L JB
L D

DESIGN MEMORANDUM NO 5 FLOOD CONTROL
BIG STONE LAKE - WHETSTONE RIVER
MINNESOTA AND SOUTH DAKOTA

UPSTREAM WORKS - WHETSTONE RIVER

DIVERSION CHANNEL
PLAN - STA 14+80 TO STA 27+40
SECTION D-1

APPROVED:

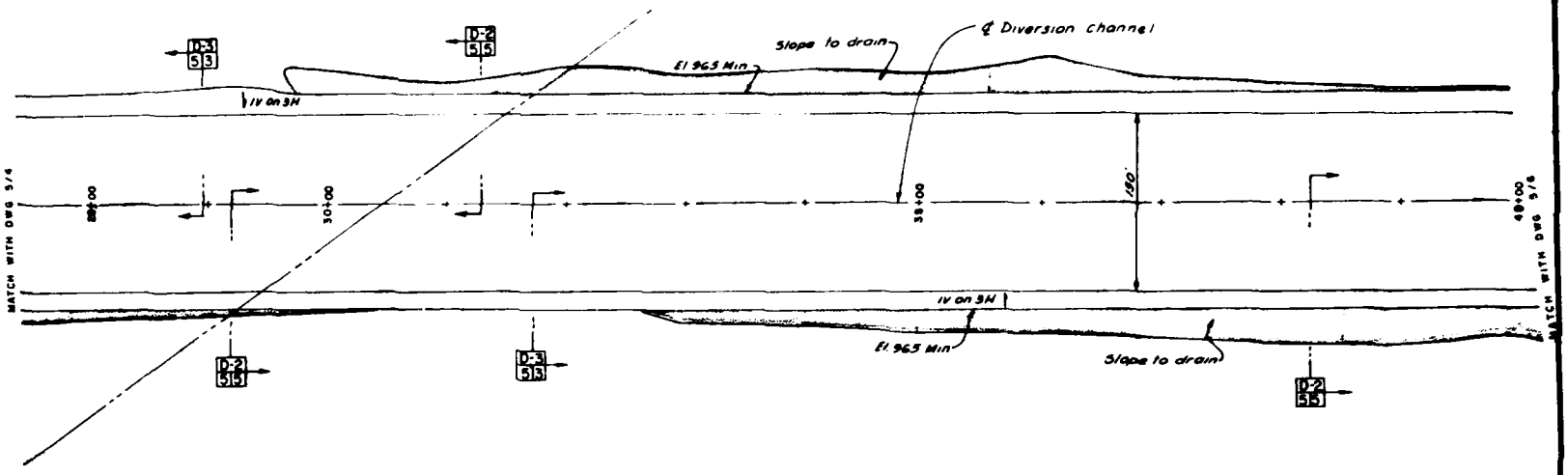
DATE
DECEMBER 1974

AS SHOWN

M34-BW-R-5/4

SHEET 4

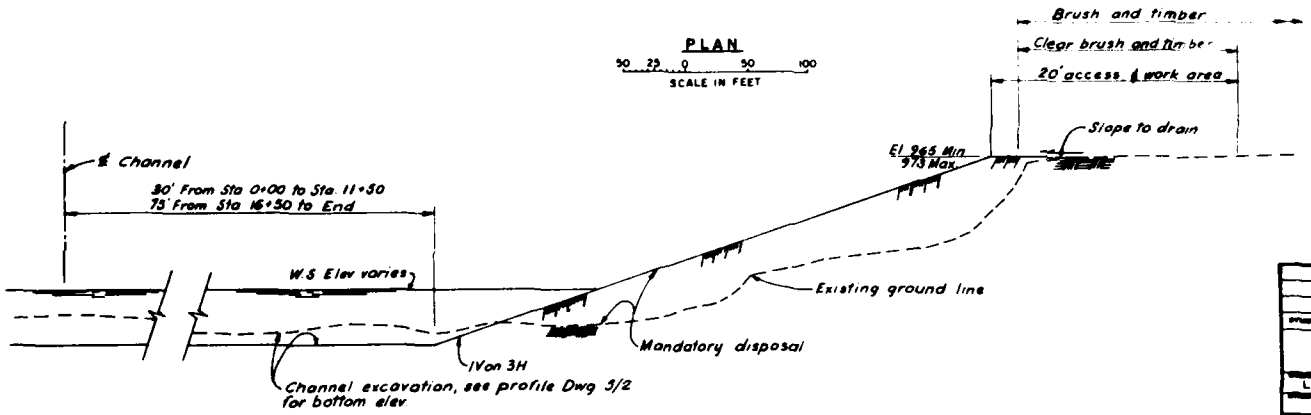
PLATE A



PLAN

50 25 0 50 100

SCALE IN FEET



TYPICAL SECTION D-2 5/5

MANDATORY DISPOSAL AREA

5 0 5 10

SCALE IN FEET

DEPARTMENT OF THE ARMY
ST PAUL DISTRICT, CORPS OF ENGINEERS
ST PAUL, MINNESOTA

DESIGN MEMORANDUM NO 5 FLOOD CONTROL
BIG STONE LAKE - WHETSTONE RIVER
MINNESOTA AND SOUTH DAKOTA
UPSTREAM WORKS - WHETSTONE RIVER
DIVERSION CHANNEL
PLAN - STA 27+40 TO STA 40+10
SECTION D-2

LD-WHP
A P
L D

SUBMITTED BY:

APPROVED

DATE:
DECEMBER 1974

AS SHOWN

M34-SW-R-5/5

SHEET 5 OF

PLATE 5

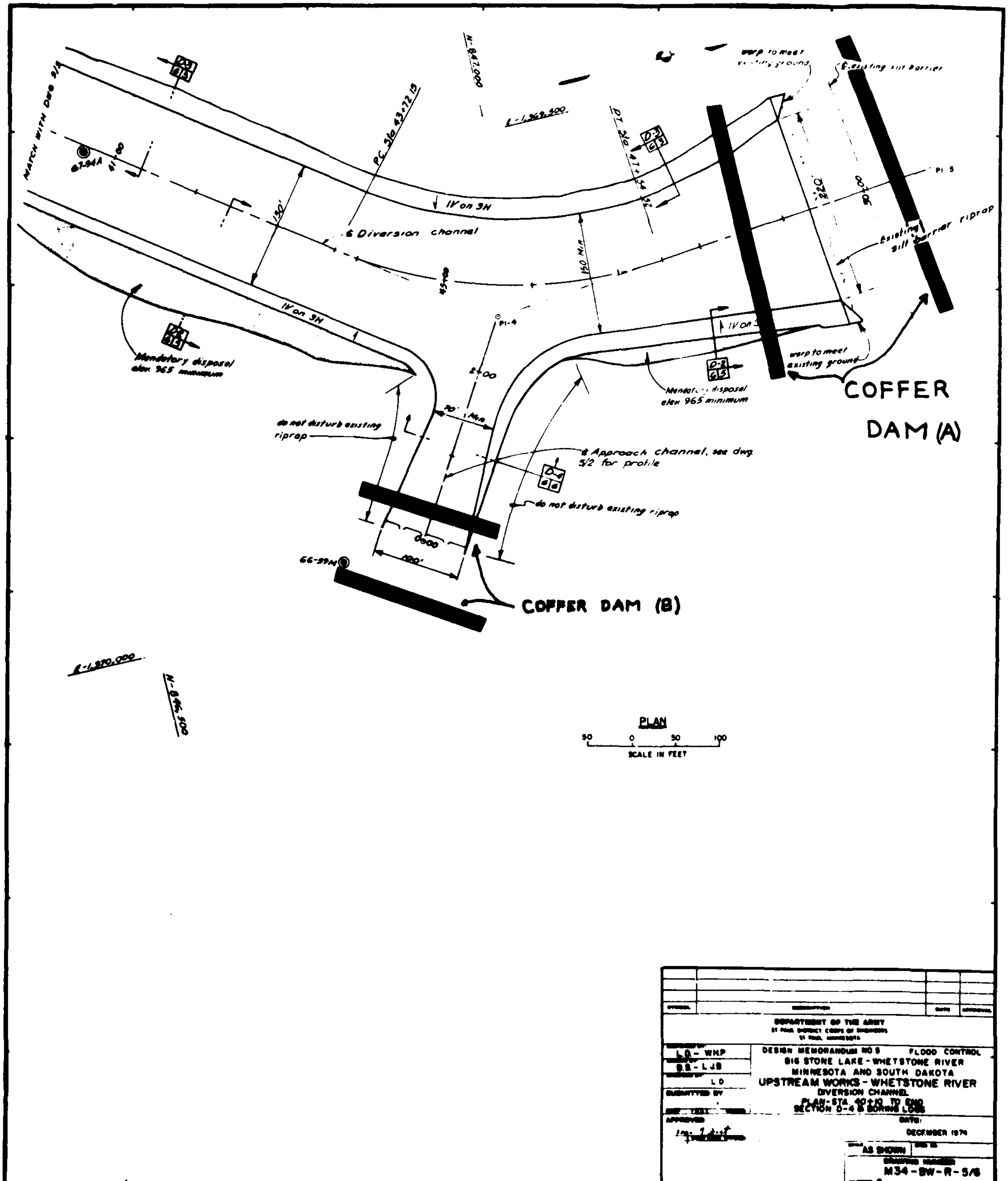

COFFER DAM (A)
COFFER DAM (B)
℄ Diversion channel
1V on 3H
150 Min
Mandatory disposal elev. 965 minimum
warp to meet existing ground
℄ Existing silt barrier
Existing silt barrier riprap
do not disturb existing riprap
℄ Approach channel, see dwg 5/2 for profile
MATCH WITH DWG 5/5
PLAN
SCALE IN FEET
DEPARTMENT OF THE ARMY
DESIGN MEMORANDUM NO 5 FLOOD CONTROL
BIG STONE LAKE - WHETSTONE RIVER
MINNESOTA AND SOUTH DAKOTA
UPSTREAM WORKS - WHETSTONE RIVER
DIVERSION CHANNEL
PLAN - STA. 40+10 TO END
SECTION D-4 & BORING LOGS
DECEMBER 1974
AS SHOWN
M34-BW-R-5/6

PLATE 6

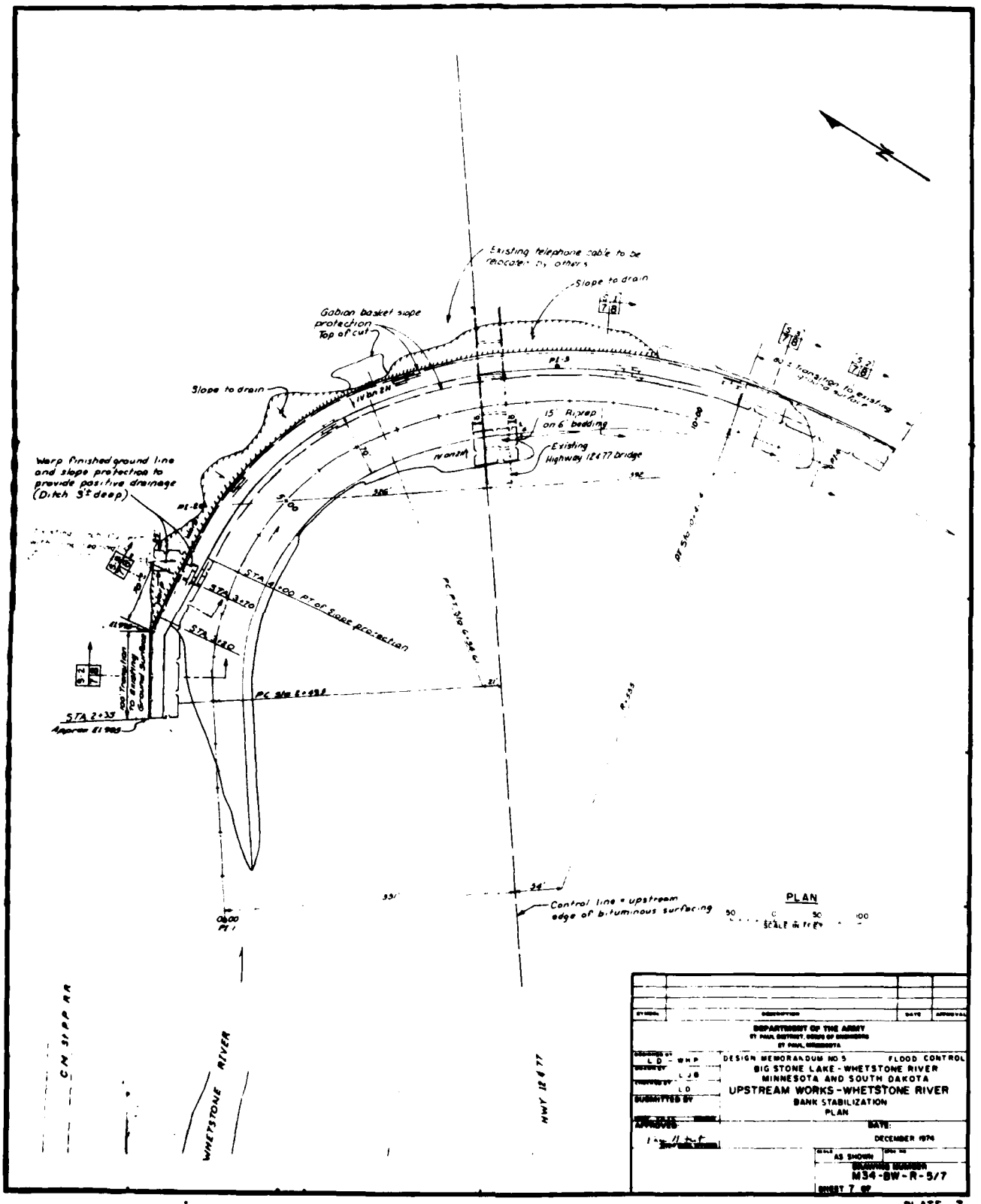
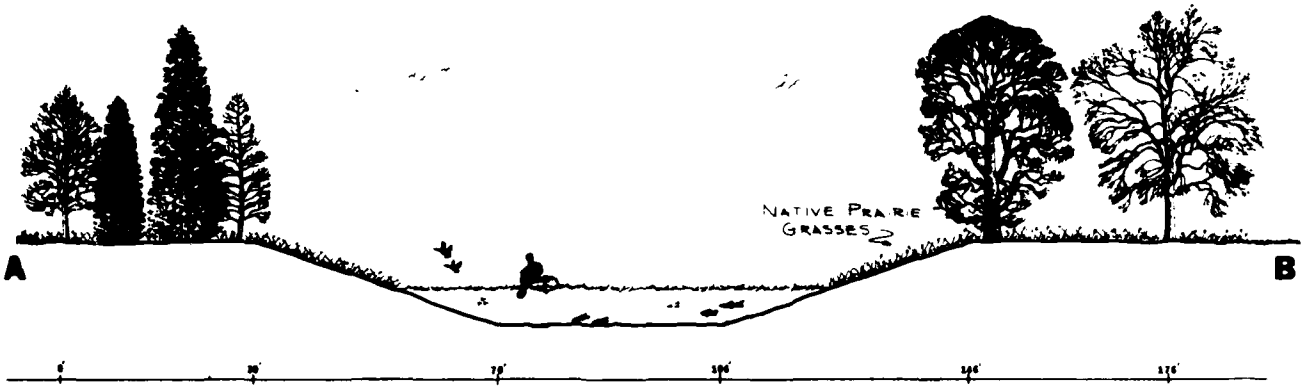
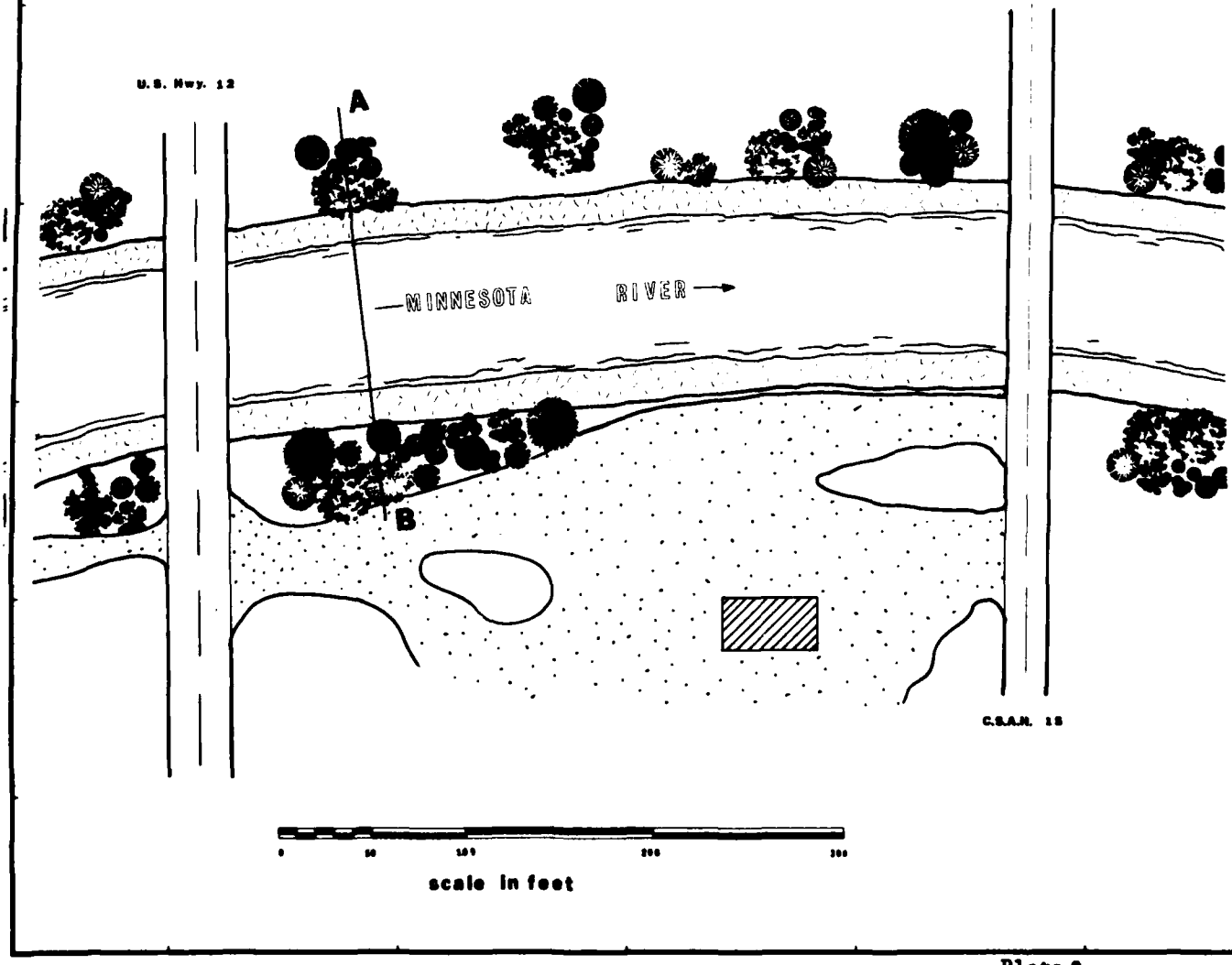

Existing telephone cable to be relocated by others
Slope to drain
Gabion basket slope protection Top of cut
Slope to drain
Warp finished ground line and slope protection to provide positive drainage (Ditch 3' deep)
15" Riprap on 6" bedding
Existing Highway 12 & 77 Bridge
STA 4+00 PT of Slope protection
STA 3+70
STA 3+40
PC Sta 2+99.8
STA 2+35
Approx El 989
Control line = upstream edge of bituminous surface
PLAN
SCALE in feet
CN SIOUX RR
WHETSTONE RIVER
HWY 12 & 77
DEPARTMENT OF THE ARMY
ST PAUL DISTRICT, CORPS OF ENGINEERS
ST PAUL, MINNESOTA
DESIGN MEMORANDUM NO 5 FLOOD CONTROL
BIG STONE LAKE - WHETSTONE RIVER
MINNESOTA AND SOUTH DAKOTA
UPSTREAM WORKS - WHETSTONE RIVER
BANK STABILIZATION
PLAN
DESIGNED BY L.D. - W.H.P.
DRAWN BY L.J.B.
TRACED BY L.D.
SUBMITTED BY
APPROVED
DATE:
DECEMBER 1974
AS SHOWN
DRAWING NUMBER
M34-BW-R-5/7
SHEET 7 OF

PLATE 7

Typical Cross Section





scale in feet

Plate 8

EXHIBIT 1 - SEDIMENT ANALYSIS

	SITE						
PARAMETER	1	2	3	4	5	6	7
Arsenic	2	2	3	4	1	3	3
Barium	700	600	500	500	200	200	700
Cadmium	< 10	< 10	< 10	< 10	< 10	< 10	< 10
Chromium (Tot)	10	10	10	< 10	< 10	10	< 10
COD (mg/kg)	35000	54000	98000	37000	14000	21000	58000
Copper	20	20	20	10	< 10	< 10	20
Cyanide	1	0	0	0	0	1	1
Iron	10000	9000	8200	9200	4100	5300	10000
Lead	40	40	20	20	20	20	30
Manganese	1400	1500	600	130	390	470	1400
Mercury	0.00	0.00	0.00	0.00	0.00	0.00	0.01
N KJD (mg/kg)	4800	6200	7200	4200	460	2400	5100
N, NH_4 as N (mg/kg)	38	6.1	48	7.3	5.2	4.4	3.5
Nickel	40	40	20	20	20	20	30
Oil and grease (mg/kg)	0	0	0	0	0	0	0
Phos. (Tot.) (mg/kg)	700	640	700	780	200	530	670
Res. LOI (mg/kg)	40300	41500	50500	35600	14400	12600	43000
Zinc	40	40	40	50	20	20	40
Pesticides							
Aidrin	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chlordane	0	0	0	0	0	0	0
DDD	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DDE	0.0	0.0	0.0	0.0	0.0	0.0	1.7
DDT	0.0	0.0	0.0	0.7	0.0	0.0	2.8
Dieldrin	0.0	0.0	0.0	0.7	0.0	0.0	0.0
Endosulfin	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Endrin	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hept. Epox.	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Heptachlor	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lindane	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mirex	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PCB	0	0	0	0	0	0	0
PCN	0	0	0	0	0	0	0
Perthane	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Toxaphene	0	0	0	0	0	0	0

* Note: Unless otherwise stated, values are in ug/kg.

END

DATE
FILMED

1-82

DTIC